

## Rejuvenation of old orchard



Old senile orchard



Light limb removal



Light limb removal



Second level limb removal



Pasting of cut portion



Sprouting in cut plants



Boudreaux pasting



Irrigation in rejuvenated plant



Intercropping in rejuvenated orchard



Fully developed canopy



Flowering in rejuvenated plant



Fruiting in rejuvenated plant

## **Rejuvenation in litchi orchard**

The following strategies and steps are involved in the rejuvenation of old senile orchards / trees of litchi.

### **(i) To be done only where needed**

In general, litchi plant starts bearing after 5-6 years of planting and attains commercial bearing stage at least after 10 years and commercially viable life (period) lies between 11 to 40 years. At this commercial juncture of bearing stage, the plant needs skillful management by proper pruning and training for status and canopy management apart from proper nutrition, irrigation and disease-pest management for quality production. It has been observed in general that orchards after attaining the age of 30-40 years even spaced at 10m x 10m, turns dense with compact top canopy covering most of the branches at the bottom and bearing fruits only on the high-tops. These plants pose problems in proper management such as pest control and, harvesting etc.

Under such circumstances, it is rather difficult to assess longevity of trees. On the other side, with rising cost of management, it may not be economical to maintain these old senile orchards of above 40 years of age. Such orchards need to be rejuvenated for further higher production of quality produce. Prior to selection of orchard or tree, it is important to look for the health, location and value of the litchi trees, which must be judged / determined before going for rejuvenation. Trunks must be healthy, wood portion / part unexposed, intact with bark and live, such trees only be selected for rejuvenation or reiterative pruning which will regain vitality and vigour. If above situations do not prevail, reiterative pruning may not result anything. These are important factors to be considered with the trees to be rejuvenated.

### **(ii) Awareness to the growers for its importance**

Considering the various pros and cons of rejuvenation, it will only be programmatic to undertake it after giving proper training for acquiring knowledge to the orchardist to develop the expert system and apply the methodology in scientific manner. The orchardist should have equipped himself with technological development and ideas that litchi tree has strong renewable ability and the breakeven point is only two years, where as establishment of new orchards will take 10-12 years to come into commercial bearing. The harvest of enhanced quality production like young commercial bearing orchards can further be obtained for atleast another 12-15 years.

### **(iii) Repairing of wounds**

Any wound on the tree if allowed to remain exposed may attract the organisms of diseases from the surrounding atmosphere. So they should be properly treated to encourage healing. If wound is small, simply painting with colour or any other disinfectant may suffice the purpose. Big hollows may be strengthened by scrapping off the inside diseased or rotten parts smearing the exposed portion with coal tar and filling them with bricks and kankar. These are finally plastered with cement.

### **(iv) Reiterative pruning**

In case of rejuvenation, heavy reiterative pruning of litchi tree is done at the height of 2 meters to 3 meters depending upon the girth and type of main trunk. About 3 to 5 main branches with outward growth from the base are marked for pruning at required height, with a plan of developing umbrella like or semi circular frame work of tree canopy. Pruning can be done either with manual saw or power operated saw. Care should be taken to avoid bark splitting or debarking at the cut end due to falling of heavy branches at the time of pruning. It is always advised to go for

reiterative pruning for rejuvenation in phase manner starting from the top light pruning to reduce weight upto the final point. After care is very important for successful rejuvenation. To avoid any external infection at the cut portion, it should be pasted with Bordeaux mixture or Copper-oxy-chloride (Blitox) immediately after pruning.

#### **(v) Time of reiterative pruning**

By adopting and following all the required scientific procedures, the best time to go for reiterative pruning for rejuvenation is August, September i.e. mainly after the rainy season. Rejuvenation is labour intensive operation and it is extremely necessary to complete the operations in time (August-September) for achieving the desired / results.

#### **(vi) Nutrition management**

After the reiterative pruning, the tree should be fed with optimum fertilizer doses, followed by irrigation near the root zone, just like the commercial orchards. The manures and fertilizers should be applied through ring method. The dose per tree as an adult bearing stage i.e. 75-80kg well rotten FYM, 2 kg Neem / Castor cake, 1.00kg Urea, 1.50kg Single Super Phosphate and 500g Muriate of Potash should be applied preferably in two split doses one during August-September and another in February-March. The micronutrients like Zinc ( $ZnSO_4$ , @ 2-3 g/l) and Boron (Borax @ 2g/l) may be applied through foliar application from one year after the reiterative pruning.

#### **(vii) Thinning and canopy development**

It has been observed that the pruned trunk / branches during the month of August, starts putting forth vegetative sprouts just after 25-30 days in case of cv. Shahi and 40-45 days in case of cv. China. The enormous numbers of branches come out and cover the entire body of the pruned plant. At this juncture, careful thinning operation is required to be done with the ultimate aim of developing solid, semi-circular or open umbrella type canopy. Shoot removal should not be done just after their emergence, rather, these should be removed sequentially after 6-8 months of rejuvenation. In this attempt, it is required to remove the sucker growth around the bottom of the trunk and thin out the excessive branches as well, keeping only 3-4 numbers nearly top-side portion on each pruned limbs of the trunk projecting all the directions and further training for acquiring desired shape. The air and light must have access to all the parts of the tree. The horizontally developing limbs should be cut back to the point where they will not hang under the weight of fruit into the row or to the ground on lower limbs.

#### **(viii) Irrigation**

Rejuvenated trees require immediate irrigation if any dry spell occurs, to avoid drying out of the trees. Irrigation is must after the manure and fertilizer application. Irrigation at regular interval of 8-10 days during hot summer season and 15-16 days during winter season helps faster vegetative growth and good canopy development. Irrigation applied to the intercrops also gives the added advantage to the rejuvenated trees, apart from maintaining / improving soil physical condition (soil health) and complete check over weed growth. Mulching during the months of April-May and September-October have been found beneficial in conserving soil moisture beneath the tree canopy, reducing the frequency of irrigation and enhancing growth.

#### **(ix) Space utilization for yield compensation**

Just after the completion of reiterative pruning for rejuvenation, the open interspaces between the plants / trees is created in the orchard like newly planted orchard. Intercrops during summer season like Black gram, Mung, Maize, Cucurbitaceous vegetable, fodder crops etc. and during rabi season, the crops like Cowpea, French bean, Pea, Potato, Mustard etc have been found most suitable. Flowering plants and annual fruit crops like papaya and banana have also been found to give good income for 2-3 years. Apart from the significant income obtained by the intercrops in rejuvenated orchards, the added advantages like improvement in the soil tilth (health), almost complete check over weed growth as well as less incidence of pests diseases are also obtained.

#### **(x) Plant health management**

Plant protection measures are equally important for healthy growth. Intensive care to manage the infestation of important pests like stem / shoot borer, bark eating caterpillar, mite, leaf roller, leaf miner and leaf cutting weevil etc. and the diseases like microbial infestations are required. Control methods may be biological, mechanical or chemical or the combination depending upon the growers' preference and specific circumstances. Leaf roller, leaf miner and leaf cutting weevil start damaging right from the beginning of the rejuvenated trees, hence care is required from that moment itself, spraying with Endosulfan / Monocrotophos @ 2ml/l or Cypermethrin @ 0.5ml/l 2-3 times during new flush emergence will save the damage from these insects. The mite can be controlled by applying miticide like dicofol / omite @ 3ml/l atleast 2 to 3 times during the months of September-October and February-March. The serious damage is being observed by the attack of bark eating caterpillar, which can be controlled by the spray of insecticide at initial stage but at tunneling stage, it is require to clean the fresh frass and webbing, finding the hole, notching the hole with and pointed spoke / poker, plugging with DDVP / Nuvan (0.1%)/Kerosene oil soaked cotton and ultimately sealing the hole with mud. Spraying of copper fungicide during the month of October and March takes care of most leaf spot and other algal / fungal diseases. Brushing / pasting of Bordeaux paste to the main trunks / branches up to one meter from the bottom keep the plant clean and save the crop from many pests infestation.

#### **(xi) Fruit yield and quality**

It has been found that the yield obtained from the old trees (non rejuvenated) is high but fetching very less price in the market due to inferior quality particularly with respect to size and wastage due to attack of many physiological disorders and attack of pests-diseases. Fruit yield and physiochemical characters of mature fruits were found to be better in fruits obtained from rejuvenated trees. Maturity period is found to be slightly delayed in rejuvenated plants.

## **Mango rejuvenation**

One of the main handicaps that have led to slow pace of evolution of the mango industry in India is the preponderance of seedling trees which are mostly of inferior type seedling plantations of "desi" mango varieties, the fruit of which is essentially "sucked out" rather than "eaten", are still found in the countryside, where no commercial cultivars are grown. Mango is a huge tree: a single tree growing in the open can occupy up to an acre of land. It can bear fruit for 60 years. The yield may vary from a few kilograms to a ton, depending on the age and bearing capacity of the tree. There are reports that nearly 30-35% seedling mango trees, which had been bearing good crop of high-quality mangoes for juice and pickle, are old and unproductive and waiting for uprooting and sale for wood

across the region. Manuring of such orchards is rare. Thus due to bad sanitation the trees are generally affected by mango hopper, stem borer, shoot borer, die-back, gummosis, powdery mildew, black tip and mango malformation. Besides, the trees are erratic in their bearing habit and the fruits produced are mostly of inferior quality, fetching little price in the market. Because of their large stature, it is difficult to apply insecticidal and fungicidal sprays. Thus such plantings are more a liability than an asset

The commercial plantations of grafted mango trees that have grown old and are not bearing good crop are also being replaced with new plantations. Planting of new orchard may involve a cost of Rs. 80-90 thousand per ha. Uprooting of inferior seedling trees and other low or non-bearing mango trees below 20 years can conveniently be top-worked with scion woods of commercial varieties. The process provides fuel wood worth of Rs.40-50 thousand and orchard space may be use for inter crops.

The process of top working or rejuvenation includes removal of old twigs and restoration of new shoots, propagation of desired variety on these newly emerged shoots. The process may take 2-3 years to be effective.

### **Method**

The process can be started in the month of December -January. Select unproductive orchard, mark the branches ahead them keeping 30cm stubs on 3-6 major limbs. A clean cut should be given to the limbs with a sharp saw to avoid bark splitting. Start beheading from base to the top. Paste cow dung slurry or copper oxichloride paste (dissolve 2 kg of copper sulphate in 15 litres of water; mix 3 kg of quick lime in 2-3 litres of water and then add the remaining 12-13 litres of water; mix the two concentrated solutions) on cut portion. If the old trees are infected with fungi, do not behead the limbs since the stubs may not sprout. Several sprouts will come up on these stubs. Plough the orchard and prepare it for inter crops. Make basins below the plants. Irrigate the plant and apply 1 kg urea per tree. Control stem borer if it has appeared. Remove weeks sprouts, control foliage feeding insect pests and grow summer season inter crop. Take proper care of inter crop and sprouts.

Select the best one or two sprouts on each stub and graft them with the desired cultivar. Remove the rest of the sprouts gently by giving a clean cut close to the stub so that these may not re-sprout. If any of these shoots are left they will overpower the newly sprouted grafts. This way one will have 6-12 grafted shoots. These grafts sprout within 20 days of grafting. The shoot above the sprouted graft should be headed back by keeping only one whorl of old leaves in November. These leaves provide food to the newly sprouted graft. Newly sprouted grafts should be covered with rice trash or plastic bags to save the grafts from frost or severe winters in December. The covers may be removed

in February-March. While removing the covers, the polythene sheet used for tying the graft union should also be gently removed.

The old sprout above the graft union should also be re-cut, keeping only the newly sprouted grafts. Care should be taken that grafts should not get damaged since these cannot tolerate even small pressure. For at least two years take care that no sprout should come up on the tree limbs other than the grafted shoots. Top-worked trees come into bearing within five years, depending upon the grafted cultivar. The old superior mango trees (dusehri-langra, etc) can also be rejuvenated similarly. If the tree is older, it is better not to head back all the main branches simultaneously, to avoid a sudden shock to the tree, which could result in the splitting of the bark of the main stem. The tree can be converted into a commercial variety in stages. In the rejuvenated trees, select 6-12 outgrowing sprouts on the 3-6 stubs during June. Remove the rest of the sprouts. These selected shoots grow very fast. During August, the apex of the shoots may be pinched to check the fast growth. This will also help in the development of side branches. The main trunk of this tree should be wrapped with hessian cloth or gunny bag during winter to avoid bark splitting.

The land rendered open to sun after top-working can be utilised for growing crops till the trees come into bearing. With rejuvenation, the benefit of an established root system of the trees can be utilised profitably. These trees can bear a good crop for a number of years once more.

### **Economic impact**

The decision to radically prune a tree should be studied carefully from a financial point of view. Will the expected increase in harvest value more than offset the lost harvest value? Naturally, there will be a significant drop in mango production with the radical pruning to reduce the height of the tree as cutting back large limbs to reduce tree size is always risky with mangoes as one may lose two or more years' production, depending on the amount cut back. Some of the value of this lost production will be recaptured through the sale of the wood cut from the tree. However, if the timing is right, flowers can develop on even large branches which have been cut back.

This production will be lost while the tree re-grows enough branches to produce the quantity of mangos lost due to the radical pruning. Pruned tree produce several times more mangos than the un-pruned tree because it will have more branches capable of producing mango. Additionally, some lost harvest value may be recaptured through pruning practices applied to the re-grown tree to manipulate harvest times to capture higher priced markets.